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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/714,207	11/14/2003	Yuan-Hung Chiu	TS03-442	2547
42717	7590	08/10/2005	EXAMINER	
HAYNES AND BOONE, LLP 901 MAIN STREET, SUITE 3100 DALLAS, TX 75202			TRINH, MICHAEL MANH	
			ART UNIT	PAPER NUMBER
			2822	

DATE MAILED: 08/10/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/714,207

Applicant(s)

CHIU ET AL.

Examiner

Michael Trinh

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 23 May 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-39 is/are pending in the application.
- 4a) Of the above claim(s) 11-39 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-10 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 1-29-2004.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

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DETAILED ACTION

*** This office action is in response to Applicant's election filed on May 23, 2005.

Election/Restrictions

1. Applicant's election with traverse of Claims 1-10 in Paper mail date May 23, 2005 is acknowledged. The traversal is on the ground(s) that "the embodiments delineated by the examiner are not patentably distinct and therefore constitute a single invention concept".

Applicant appears to allege that the embodiments or species are not patentably distinct. Thus, Applicant should submit evidence or identify such evidence now of record showing the species to be obvious variants or clearly admit on the record that this is the case. In either instance, if the examiner finds one of the inventions unpatentable over the prior art, the evidence or admission may be used in a rejection under 35 U.S.C. 103(a) of the other invention.

With further regard to Applicant's response that "...claim 1 is considered generic for all of the claims, and if allowed, the remaining species (claims 11-39) can also be allowed without restriction". However, it is noted present claim 1 includes at least the step of "transferring said opening through an exposed layer at the bottom of said opening in said substrate" that has not been recited in independent claims 11, 19, and 29 of the remaining species (claims 11-39). Applicant is reminded that, upon the allowance of a generic claim, applicant will be entitled to consideration of claims to additional *species which are written in dependent form or otherwise include all the limitations of an allowed generic claim as provided by 37 CFR 1.141*. If claims are added after the election, applicant must indicate which are readable upon the elected species. MPEP § 809.02(a).

The requirement is still deemed proper and is therefore made FINAL.

2. Claims 11-39 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

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A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(c) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

4. Claims 1,5 are rejected under 35 U.S.C. 102(b) as being anticipated by Chen et al (6,025,273).

Chen teaches an integrated process flow involving a patterned photoresist layer 18 on a substrate 12/10 in an etching tool that has one or more process chambers, said patterned photoresist layer 18 having an opening with a top and bottom that extends through at least one underlying layer 16 in said substrate, comprising: (a) performing an oxygen ashing step to remove said patterned photoresist layer 18 (Figs 3-4; col 4, lines 51-65); (b) performing a halogen containing plasma step (col 4, lines 64 through col 5, line 5); and (c) transferring said opening through an exposed layer at the bottom of said opening in said substrate (Fig 5, col 5, lines 1-20). Re claim 5, wherein said halogen containing plasma step involves a plasma of CF_4 , CHF_3 , C_2F_6 , which plasma satisfies $\text{C}_x\text{F}_y\text{H}_z$ where x and y are integers and z is an integer or is 0.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(f) or (g) prior art under 35 U.S.C. 103(a).

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6. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al (6,025,273) taken with Shan et al (6,232,236) and Levenson et al (2001/0038089).

Chen teaches an integrated process flow involving a patterned photoresist layer 18 as applied to claims 1 and 5 above.

Re claim 2, Chen lacks listing etching tool being a split power etcher, a dual power etcher, a single power etch tool, a reactive ion etcher, or a conventional barrel, direct, or downstream type of ashing tool.

However, Shan teaches (at col 5, lines 11-29; col 3, lines 46-55; col 4, lines 15-35) etching tool including a split power etcher, a dual power etcher, a single power etch tool, a reactive ion etcher. Levenson teaches (at col 4, paragraph 46; paragraphs 5-12) plasma ashing tool including down flow, barrel, direct, and downstream type of ashing tool. Chen also teaches (at col 4, lines 55-67) the etching tool including reactive ion etching (RIE) or a HDP etcher.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to perform the oxygen ashing and halogen plasma step of Chen by employing the etching tool of a split power etcher, a dual power etcher, a single power etch tool, a reactive ion etcher, or a barrel, direct, or downstream type of ashing tool, as taught by Shan and Levenson. This is because these tools are alternative and art recognized equivalent tools so that the plasma ashing and etching steps can be effectively performed in a reliable manner.

7. Claim 3-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al (6,025,273) taken with Applicant's admitted prior art (present specification page 1).

Chen teaches an integrated process flow involving a patterned photoresist layer 18 as applied to claims 1 and 5 above. Chen teaches (at col 4, lines 55-67) the etching tool including reactive ion etching (RIE) or a HDP etcher.

Re claims 2-3, Chen lacks explicitly mentioning to perform the steps in the same process chamber of the etching tool.

However, Applicant's admitted prior art teaches (at present specification page 1, last paragraph) to perform the ashing and etching steps in the same process chamber of the etching tool.

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Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to perform the steps of oxygen ashing, halogen plasma, and transfer of Chen in the same process chamber of the etching tool. This is at least because of the desirability to reduce production and equipment cost and processing time, since only a tool is needed.

8. Claim 5-6 are further rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al (6,025,273) taken with Hayasaka et al (5,298,112) and Hori et al (5,411,631).

Chen teaches an integrated process flow involving a patterned photoresist layer 18 as applied to claims 1 and 5 above. Re claims 5-6, Chen already teaches (at col 4, lines 58 through col 5, line 5) halogen containing plasma including Cl_2 , HBr , CF_4 .

Chen does not list all halogen plasma as recited in claim 5, the plasma includes CF_4 , CH_2F_2 , SF_6 , NF_3 , Cl_2 and $\text{C}_x\text{F}_y\text{H}_z$ where x and y are integers and z is an integer or is 0; and Re claim 6, HBr is included in combination with the above halogen plasma.

However, Hori teaches (at col 5, lines 36-54) halogen containing plasma including CF_4 , NF_3 , SF_6 , Cl_2 , CHF_3 , in which $\text{C}_x\text{F}_y\text{H}_z$ where x and y are integers and z is an integer or is 0, wherein HBr is included in combination with the plasma including Cl_2 . Chen already teaches (at col 4, lines 58 through col 5, line 5) halogen containing plasma including Cl_2 , HBr , CF_4 .

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to perform the halogen containing plasma step of Chen by employing available known halogen containing plasma including of CF_4 , CH_2F_2 , SF_6 , NF_3 , Cl_2 and $\text{C}_x\text{F}_y\text{H}_z$ where x and y are integers and z is an integer or is 0, with HBr included in the halogen plasma, as taught by Hori and Chen. This is because these halogen containing plasma are alternative and art recognized equivalent plasma etchants so that unwanted residues and material can be effectively removed from the substrate in a reliable manner.

9. Claims 7-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al (6,025,273) taken with Yeh et al (6,207,565) and Webb et al (5,228,950).

Chen teaches an integrated process flow involving a patterned photoresist layer 18 as applied to claims 1 and 5 above.

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Re claims 7-8, Chen already teaches (at col 4, lines 55-67) using reactive ion etching (RIE) or a HDP etcher for performing the halogen containing plasma step, but lacks detail about process parameters of flow rate, pressure, temperature, power, time period, as recited in claims 7-8.

However, Yeh teaches (at Fig 6, Table I, Step 2) performing a halogen containing plasma step, with a gas flow rate of about 360 standard cubic centimeters per minute (sccm), a chamber pressure about 0.5 Torr, a chamber temperature of about 250 degree C, a RF power of about 975 Watts, and for a period of less than about 2 seconds. Webb teaches (at col 3, line 9 through col 4, lines 60) performing a NH₃-halogen containing plasma step, with a gas flow rate of about 10-500 standard cubic centimeters per minute (sccm; col 3, lines 23-40), a chamber pressure about 20 milliTorr to about 1Torr (col 3, lines 9-22), a chamber temperature of about 25 to 150 degree C, a RF power ranging of about 50-400 Watts, and for a period of about 5-60 seconds (col 4, lines 1-5, 51-60).

Therefore, the subject matter as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made to select the portion of the prior art's range flow rate, temperature, a RF power ranging for top RF power and bias RF power, pressure, time period, etc., as taught by Yeh and Webb, and known in the art, which is within the range of applicant's claims, because it has been held to be obvious to select a value in a known range by optimization for the best results, and would be an unpatentable modification, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation". *In Re Aller* 104 USPQ 233,255 (CCPA 1955); *In re Waite* 77 USPQ 586 (CCPA 1948); *In Re Swanson* 56 USPQ 372 (CCPA 1942); *In Re Sola* 25 USPQ 433 (CCPA 1935); and *In Re Dreyfus* 24 USPQ 52 (CCPA 1934).

10. Claims 9-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al (6,025,273) taken with Verhaverbeke et al (2003/0045098).

Chen teaches an integrated process flow involving a patterned photoresist layer 18 as applied to claims 1 and 5 above.

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Chen already teaches using the patterned photoresist layer 18 during semiconductor fabrication, wherein, the opening exposes an underlying silicon layer 12 and step (c) forms a shallow trench in the silicon layer 12 (Figs 7,5; col 5, lines 1-49).

Chen thus lacks mentioning his method for forming a shallow trench in the substrate (claim 9); and for forming a gate electrode (claim 10).

However, Verhaverbeke teaches (at Figs 16A-16C) applying the method for forming a shallow trench in the substrate (claim 9), wherein the method is also applied (at Figs 15A-15E) for forming a gate electrode (claim 10).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the method of Chen for removing residues during the formation of a shallow trench in the substrate and during the formation of a gate electrode, as taught by Verhaverbeke. This is because of the desirability to eliminate unwanted residues from the substrate so that a high quality integrated device can be manufactured in a reliable manner.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael M. Trinh whose telephone number is (571) 272-1847. The examiner can normally be reached on M-F: 8:30 Am to 5:00 Pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on (571) 272-1852. The fax phone number is (571) 273-8300.

Any inquiry of a general nature or relating to the status of this application should be directed to the receptionist whose telephone number is (703) 308-0956.

Oacs-17



Michael Trinh
Primary Examiner